NATURAL HISTORY

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BEZOAR STONES, CALCULI,

AND OTHER

ANIMAL CONCRETIONS,

BY

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There is a great variety of adventitious products met with in the animal body, composed of various substances, both organic and inorganic, implanted in the different hollow viscera, as they frequently are, or developed in the various secretory organs, the muscular tissue, and the brain. And none are more interesting in their formation, or have excited a greater curiosity among naturalists and the superstitious, than those stony concretions found in the alimentary canal of certain ruminants.

The occasional presence of these bodies in the stomach and bowels of animals must have been known to the savage and the hunter from remote antiquity. The early anatomists were aware of these formations, and some conjectures had been made concerning their physical properties by Pliny, Galen, and Aristotle; but no particular value was placed upon such concretions until the Arabian physicians in the tenth century

called attention to them as a novel article of *materia medica*. The marvelous virtues which this new medicine was supposed to possess, and the wonderful cures that were claimed to follow its administration, gave a new impulse to the fame of the healing art in the oriental world.

The history of these bodies affords a remarkable instance, says Taylor, of the tendency of the human mind to attribute miraculous curative powers to substances, the nature and origin of which are enveloped in mystery. These calculi, which modern science has shown to consist merely of the undigested excrementitious parts of the food of different animals, were formerly termed Bezoar-stones, and were regarded as precious and sovereign remedies for all kinds of disease—were supposed to possess the power of counteracting the effects of poison, and for many years were held in so much esteem that they were regarded as valuable and acceptable presents by the native princes of the East. But the increasing knowledge and experience of mankind have gradually dispelled such illusions from the practice of scientific medicine, and have now stripped these worthless drugs of that renowned reputation in which superstition and credulity had for a long time enshrined them.*

Bezoar is an oriental term, signifying, according to the best authority, the destroyer of poison, but there is some doubt in regard to its etymological origin. Dr. Fryer,† who traveled for several years in the East, claims that *Pahazar* is the right orthography, and that it is composed of two Persian words, *Pa*, against, and *Hazar*, poison. But Kœmphfer‡ writes *Pasahr* as the original, and seems to question its com-

* Descriptive Catalogue of the Calculi and other Animal Concretions in the Museum of the Royal College of Surgeons, in London, by Thomas Taylor, F. R. C. S., 4to, in two parts, 1842 and '45, with supplement, 1871. Illustrated with seventeen colored plates, containing 162 figures of Calculi.

† A new account of East India and Persia, in eight letters. Folio, London, 1698.

‡ "Lapis Bezoar Orientalis verus et pretiosus Pasahr, ex quo nobis vox Bezoar enata est. Sceptici nostri philosophi nomen petunt ab Hebræa Bahal quod dominum, et Persico Sahr quod venenum significat, et lapidem veneni domito rem vocant. Sed hæc ex similitudine vocabulorum efficta derivatio est."—*Amœnitatum Exoticarum politico-physico-medicarum. Lemgoviæ* 1712, page 398.

pound derivation; while Gesner* and other naturalists derive it from *Pazan*, the common name of the wild goat in the mountainous districts of India, from which these concretions were first taken. These animals were much sought after for these medicinal products which their stomachs contained. And naturalists have seemed to appreciate this noted quality, in their descriptions of the quadruped Aldrovandus, who wrote extensively concerning the virtues of bezoar-stones, characterizes this species of the goat as the *Hurcus Bezoardicus* in zoological language, and Linnæus, in his well-known Natural System, is no less significant in his appellation of *Capra bezoartica* for this famous animal.

Similar concretions have been found in a large number of herbivorous animals, but those from the goat first attracted attention, and have been always regarded as the true oriental bezoar-stone, and have accordingly been the most appreciated. They were considered to be so efficacious that many of the superstitious people wore them as amulets and charms to ward off infectious diseases, and prevent the influences of demons. It is reported that $1,500 in gold has been paid for a genuine specimen of one of these mysterious talismans.

It was the custom in Holland, and also among the Portuguese, who were not able to own a bezoar, to hire them during the prevalence of epidemics, for about a dollar a day. Tavernier† gave 500 crowns for a certain specimen, and regarded it a good bargain, for he afterwards exchanged it to advantage. They increase in value according to their size, and he once sold one, weighing four ounces, for $370. These concretions were frequently set in hoops of gold or silver, and Kœmphfer has given us a fine plate‡ of one, having a chain of the precious metal attached, in order that it might be safely suspended in the liquids which it was desired to medicate. In his travels, he rarely ever met with a Persian of affluence

* See Conard Gesner's Histore of Foure Footed Beastes, by Ed. Topsell. Folio, London, 1607.

† Six Voyages of John Baptista Tavernier through Turkey, Persia, and East India. London, 1677. Reprinted in Harris's Collection of Voyages, Vol. I, folio edition, 1744.

‡ Amænitatum Exoticæ, etc., page 394.

or distinction who did not possess one of these valuable calculi, which he preserved with a jealous care.

And the high esteem in which these bodies were even more recently held is well illustrated by that royal present, consisting simply of three oriental bezoar-stones that the Shah of Persia sent Napoleon Bonaparte, as a token of personal friendship and respect.

It is not strange, therefore, that the demand for these calculi was once greater than the supply. Hence numerous imitations soon found their way into the market. These were composed largely of chalk, pipe-clay, and bitter herbs, flavored with various gums and musk, and when finished wore a high polish, in a certain degree imitating the genuine bezoars. It is believed by Kœmphfer and others that the eunuchs of the seraglios manufactured and sold these spurious articles. And he speaks of a species of quack medicine that was known as the *Pedra Cordial*, which was made of various aromatic drugs mixed with the powdered bezoars into globular-shaped masses. These were often gilded and stamped on one side with a figure of a goat, and the other with N. M., the initials of Nicolaus Monitius, a Romish priest who superintended this work at Goa, and hence this medicine-ball was also known as the *Lapis de Goa.*

The concretions from the animals of the New World were called Occidental Bezoars, in contradistinction to those in the East, but the term was afterwards somewhat indiscriminately used and applied by various authors to any calculous formation that did not possess the true character of those from the goat. Many calculi were brought from South America and the West Indies, and Walton, who had thoroughly investigated the subject, says: "It is peculiar to the order of ruminants to form two species of concretes in the stomach, which, though they have the same origin, are nevertheless different. These are, the egagropiles, or hair-balls, taken from the insides of horned cattle; and the others are bezoars, or solid stones, discovered in the algazel and other quadrupeds of India and Persia, and in the sheep of Peru; but mostly in the guanaco.

"The first are found in the insides of the cows that feed on

the pampas of Buenos Ayres, where they are extracted, of an enormous size; and we have at present in our possession one from that country, of a flat circular shape, that weighs eight pounds and a quarter, and measures two feet eleven inches and a half in circumference, two feet eight inches round the flat part, nine inches diameter also in the flat part, eleven inches diameter in the cross part; and on immersing it in water, we found it displaced from the pail upwards of eight quarts, which makes its bulk, or solid contents, correspond to 462 cubic inches. This is the largest egagropile supposed to have been seen in England; but occasionally small ones, of the size of a turkey's egg, are found in our own cattle. On the upper and under flat parts, two holes were visible, through which the concreted hair was noticed, and on being put into water, from the small globules of air that arose, it was evident that, being of a spongy nature, some water was imbibed by them. These holes appeared to have been adhering points to the intestines, but the outside coat was a perfect crust of a limy substance, smooth; but, on knocking, the ball had a hollow sound.

"The whole four species of Peruvian sheep occasionally produce these concretions, but the real bezoars are seldom found in any but the wild kinds; for in the llama they rather become egagropiles from the quantity of hair he eats from his crupper. The Indians of Peru, to this day, are strongly impressed with the idea, that the bezoar originates from the animal feeding on certain poisonous plants. This is a point well worthy of clearing up. Though at first sight it seems a paradox that animals should be nourished by a subtle poison, and that this should afterwards produce a remedy, so long considered valuable, yet this is partly reconciled when we reflect that the goat and the quail preferably feed on, and are fattened with, hellebore, notwithstanding it is poisonous to man.*

"The French naturalists incline to think that in Asia and Africa certain classes of quadrupeds produce the bezoar, from

* Lucretius seems to have been aware of the same fact when he says: "*Ut quod aliis cibus est, aliis fiat acre venenum.*"

feeding on the mountains, where the strength and activity of the plants are great, and that they thence constitute a kind of residuum. The animals of the mountains of Europe, where the quality of the plants and herbs is more temperate, according to Buffon produce nothing but egagropiles of no virtue, which only contain hair, roots, and filaments, too hard for the digestion of the animal.

"In the mountains of the torrid zone, other animals besides the guanaco and vicuña produce them; and Acosta says that the stags, and even squirrels, contain them. The two wild kinds of Peruvian sheep afford them in nearly an equal proportion, though it has been generally thought that the vicuñas produce most. In medicine and trade they are called the occidental bezoars, but, though larger, they are not so much esteemed as the oriental ones. Those in greatest repute are of a dark green color; but notwithstanding they were formerly considered as a most powerful alexipharmic, their virtues in Europe are now held as imaginary, and they are for that reason almost discarded from modern practice. In South America they however keep their ground, and their efficacy was highly appreciated by the ancient Peruvians, who were extremely jealous of the Spaniards obtaining any knowledge of their acquirements in medicine.

"The Indians formerly, and even partially to the present day, use a composition made of the bezoar-stone, powdered, amalgamated with some other ingredients, and then baked into cakes, to rub off the beard from their faces, in the way that a pumice-stone might be applied. This custom is yet found prevalent in those parts of the interior country that are not yet civilized, where the ancient usages and customs remain unchanged."*

These bezoars, according to Walton, are oval, sometimes round, solid concretions, of the size of a turkey's egg, with no hair, but of a heavy limestone nature, composed of a number of concentric coats, or laminæ, each adhering, but when broken peeling off in distinct pieces. The outside of each is

* An Historical and Descriptive Account of the Peruvian Sheep, by William Walton, Jr., with four colored plates of the animals. 8vo, London, 1811.

perfectly smooth, polished, lustrous, and of a deeper color than the inside, so that they appear to have been formed successively in layers, one after the other. Their commencement, or nucleus, appears to have originated from something the animal has received on its stomach, without being able to digest it: for in those we have in our possession the nucleus is a small flint stone, and the bezoar takes the larger form of what this was in miniature. In others, the nucleus indicates to have been a piece of wood, or some fibrous matter, that has not found passage through the vessels of digestion.

And Dr. Shaw, in describing the solid concretions formed in the stomachs of various ruminants from a zoological point of view, observes that those found in the eastern regions have always been considered as far superior to any others. The genuine oriental bezoar of the shops is commonly the size of a kidney-bean, but often far larger, of an extremely smooth surface, and of a dark olive color; and in the middle is either a cavity, or else some powder or vegetable matter. The bezoar has, in general, no particular taste or smell, but in the eastern regions it is said to be sometimes found of a highly aromatic character, and when reduced to powder retains its usual color.*

Naturalists are not agreed as to the location and the mode of formation of the various concretions of the alimentary canal, and there are few people to-day who have even taken the trouble to investigate the matter. And as these Peruvian bezoars once attracted so much attention, it may not be uninteresting to know how abundantly they were produced, and in what part of the body found by the first civilized discoverer of these calculi. Pedro de Osma of Lima, in a letter to Dr. Monardus, bearing date of December 16, 1568, says:

"We tooke out of the first beast which we killed, from that little purse whereunto he doth returne to chew his Cudde, when he lieth on the grounde, nine stones, and it seemeth that by reason the hearbes which they feede upon be of so great vertue, the juyce of them going to that place by the order of Nature, these stones are ingendered, which have so great

* General Zoology. By George Shaw, M.D., F.R.S. London, 1801. Vol. II, p. 317.

felted together, and quite often hair will be found mixed with it, especially in the cosset. These may also become incrusted or coated over, and the shell is composed of an animal matrix originally in the form of mucus in which there is a deposition of mineral matter, usually the phosphate and carbonate of lime.

These hair-balls are sometimes of enormous size. There is one in the museum of the Royal College of Surgeons that is ten inches in diameter;* and not unfrequently several have been found in a given animal, and had all the material been united it would have made a specimen of no small magnitude.

Any indigestible substance or foreign body may serve as a nucleus for an intestinal concretion, and in the early stages may be known from the nature of its beginning. Hence a small incrusted hair-ball may be found in the center of a large bezoar-stone; the outside of which is hard and unyielding, made of ammonia-magnesium phosphate, as most of them are. Again, a dust-ball, formed of the hairs of the oat and other vegetable material, is often the nucleus, and these are accordingly denominated the oat-hair calculi, which are of frequent occurrence in livery horses, and very troublesome.

A hard ball of manure may serve the same purpose, and when incrusted with the salts of lime, are known as dung-balls or mixed calculi. I have one taken from a horse in Vermont, which caused its death, that weighed thirteen ounces, measured four inches in diameter, and was so large that it could not be made to pass the bowels.

The triple-phosphate calculi in horses are very common, especially if they are freely fed upon bran; hence millers' horses are said to be much more liable to these concretions. A case occurred in Bridgeport where seven large calculi were taken from the bowels after death.

Concretions, bezoars, and calculi are synonyms in general use among physiologists, and the derivation of the latter term is from the Latin word *calx*,† from the belief of the early chemists that this alkaline earth constituted the principal basis of the animal concretions; but it was soon found that

* See Taylors' valuable Catalogue, page 217. † Lime.

magnesia, soda, potash, and ammonia also enter largely into their composition. Priority and general usage has, therefore, sanctioned a secondary definition of this term, and it is now applied to all the sedimentary formations in the animal economy. A hardened deposit of cholesterine in the gall-sac is appropriately known to the profession as a biliary calculus, and a concretion of the phosphate of lime from the intestines would only receive the same appellation to indicate its true pathological character as a foreign body.

The chemical composition of a calculus may be quite simple or very compound. Sometimes a single substance may constitute the entire mass, as in the case of a gall-stone and the uric acid gravel, while we often find one of a varied constitution like the ammonia-magnesium phosphates associated with the carbonate and oxalate of lime. But some one principle usually predominates, and thus imparts a peculiar character by which a concretion may frequently be recognized.

Urinary calculi in the lower order of animals are far more simple in their composition than in man. They are not composed of as many layers, nor is the chemical nature of their constituents as complicated. They rarely contain those complex organic principles which constitute the greater part of the concretions from the human subject; but they are made up of carbonates, phosphates, and other inorganic compounds. Another peculiarity in these animal calculi has often been noticed—that they are more homogeneous in their accretions, and not unfrequently consist of the same uniform material throughout. Hence the alternating structure is seldom or never met with in the urinary concretions of our domestic animals.

The carbonate of lime is a very prominent constituent in the urinary calculi of herbivorous animals. This salt cannot be precipitated in an acid solution, hence it never occurs normally in the urinary deposits of the carnivora; but in the horse, ox, and sheep, where the urine is almost invariably alkaline, it enters into the formation of by far the greater number of calculi met with in the urinary system. They are

seldom found absolutely pure, for the carbonate of magnesia and the phosphate of lime also enter their composition in variable quantities according to the feed, and the general condition of the animal.

These concretions in the ox are usually not very large, but occasionally one has been taken from the kidney of nearly an inch in length. Those in the bladder are sometimes very numerous. Hundreds of them have been found varying in size from the finest sand to a black cherry, and sometimes larger, in case there are but few. They are globular in form, usually quite smooth, and polished on their surface, and occasionally tuberculated, resembling the mulberry calculus of the human subject.

These concretions generally present pseudo-metallic luster, as though they had been silvered and brightened, and have, therefore, been called "pearls" from the ox. The smooth ones, when broken, readily separate into a series of concentric layers, but the tuberculated ones do not; they are very hard and massive in structure.

Similar calculi occur in the horse, and are almost of the same identical composition, consisting mostly of the calcium carbonate; but those found in the hog contain a small proportion of the carbonate of magnesia.*

These calculi, when too large to pass through the urethra of the ox, get lodged in the curve of the canal, as seen in the accompanying diagram. Inflammation occurs around the obstruction, and there is a difficulty in urinating, and with only a small drizzling stream. The tissues of the urethra become swollen, thickened, and the canal closed. No water is seen now to pass, the bladder fills and soon becomes distended to an enormous extent. The ox is now in excruciating pain, is very uneasy, gets up and lies down frequently. He tries to urinate, but in vain. These symptoms continue for about

* See article, *Concretions*, in Simon's Animal Chemistry, Sydenham edition, vol. II, London, 1846; also an Essay on the Chemical History of Calculous Disorders, by Alexander Marcet, M.D., F.R.S., London, 1817; and Calculous Concretions in the horse, ox, sheep, and dog, by Dr. W. J. T. Morton, London, 1844, with four colored plates of specimens.

twenty-four hours, when the animal becomes easy, and the farmer begins to be encouraged, thinking that his patient is getting better; but this is not the case. The bladder has now burst, and the symptoms are of course less aggravating; the animal lies quietly, looks back at his flanks, and moves occasionally. In this condition an ox will live for several days without giving the owner any apprehensions of a fatal termination, and Dr. Cruzel has seen one survive thirty days without taking any nourishment.*

The treatment consists in opening the urethra and thus removing the calculus at an early stage in the disease. This is not a very difficult operation in skilled hands, but when the bladder bursts the surgeon looks upon the case with despair.

The Professor was interrogated at considerable length in regard to the proper method of removing calculi and other obstructions of the animal functions. The questions were answered quite fully by the Professor, and in the course of his explanations he described some delicate and critical operations successfully performed by himself, in a very interesting manner, illustrating by the free use of the blackboard. At a late hour, the meeting adjourned to Friday morning, at 10 o'clock.

APPENDIX.—SPECIAL REPORT ON A CASE OF RUPTURED BLADDER IN THE OX.

At the close of my lecture, R. S. Hinman of Birmingham, a member of the Board, called the attention of the audience to the condition of one of his oxen, that had been troubled for some time with the "gravel," as I had described. I accompanied Mr. Hinman on his return home from the Norwalk meeting, Saturday, December 14th, to examine the case. We found the animal walking about the yard, but with a tottering gait, eyes glassy and sunken, trembling in the flanks, and evidently very much prostrated. The lower part of the abdomen was plump and hard, and very dull on percussion. I detected at once a calculus in the sigmoid flexure of the urethra, and no bladder could be felt. These indications in

* Edinburgh Veterinary Review, vol. I, page 79, 1859.

connection with the fact that no water had been passed since Monday morning, placed my previous suspicion of the nature of the trouble beyond a doubt. I therefore diagnosed a ruptured bladder and the abdominal cavity filled with urine.

This opinion was met with sharp opposition by some of the neighbors and bystanders, who having taken a more favorable view of the matter, believed that the patient might yet recover; for they could not understand how an animal should live so long if that was the case. But Mr. Hinman having watched the development of symptoms from the beginning, had no confidence in further treatment; and regarded the ox as practically worthless. Permission was therefore freely given to sacrifice the creature in behalf of veterinary science, that we might make a satisfactory examination of the interesting points connected with the malady. And through his kindness I have been able to glean the following

HISTORY OF THE CASE.

The ox first showed a difficulty in passing water about the 20th of August. He then urinated but a little at a time, and the stream was very small. This continued for some time without much variation. In about a month the act of urination became painful, but his appetite seemed to be good and he was kept at work.

Small doses of resin were given occasionally, but without effect. On the 23d of November, a tablespoonful of saltpetre was added to the resin, and not perceiving any benefit, an ounce and a-half of spirits of niter was given, followed in twelve hours with a large spoonful of turpentine. The effect was quite apparent, but the result unfavorable, as the sequel proved. The ox stopped eating, suffered very much, and the difficulty in urinating was thereby increased. Upon examination Mr. Hinman found the bladder completely distended, compressing the rectum, and as defecation was thus interfered with, a quantity of fæcal matter covered with mucus and tinged with blood, was removed from the bowels, which seemed to give relief for some hours. All drink and diuretics were for a short time withheld; soothing injections used, slippery

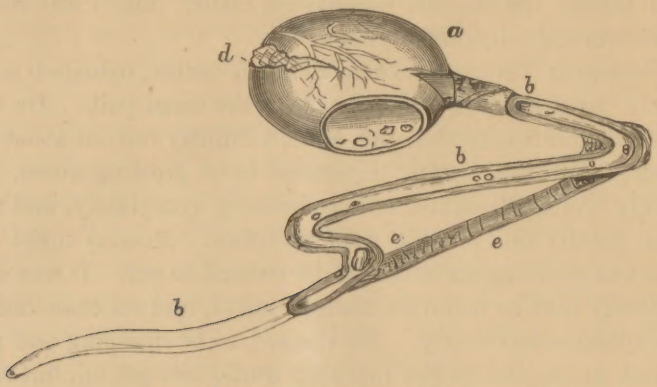
elm with warm mashes were given, followed with a dose of linseed oil. In twenty-four hours the animal was partially relieved, the bowels moved freely, but the urinary trouble remained the same. He continued to eat and drink as usual; and though the bladder was always rather full, it was never so enormously distended afterwards.

December 7th the ox seemed much better, urinated more freely but slowly, and attended with the usual pain. He was worked a portion of that day, and on Sunday ran out about the fields, but in the evening he seemed to be growing worse, and during the night saturated his bedding completely, and was thus greatly relieved the next morning. Monday night the case was again aggravated and he refused to eat. It was with difficulty that he could be made to stand, and on examination the bladder was empty. He seemed to be drooping and preferred to lie, and in the morning would not get up, but that night he rallied again, and ate a little. Wednesday morning, when Mr. Hinman left for Norwalk, the ox was at the manger eating. From then until we saw him Saturday noon he ate sparingly, but drank regularly, and was at the trough when we returned.

POST-MORTEM EXAMINATION.

The blood was thin and watery, and did not coagulate exposed to a bright sunlight. There was a urinous odor about the flesh when the skin was removed. With the carcass lying on the back I tapped the left flank and drew forty gallons of urine, by measurement, from the abdominal cavity. There was considerable floating lymph present, which several times interfered with the stream from the side, but the quantity was not estimated. The peritoneal inflammation was most marked in the region of the kidneys, with quite extensive exudation into the cellular tissue. The bowels were almost free from any inflammatory blush, and no adhesions to be found. A rupture of three inches in length had occurred at the fundus, or anterior extremity of the bladder, as seen in the cut at *d*. And on opening the urethra at the lower part of the curve, as before designated, we found the offending calculus which fully corroborated my diagnosis, and to the satisfaction of all con

cerned. The calculus shrunk some on drying. It now measures $\frac{7}{16}$ of an inch in diameter and weighs six and a-half grains. Its surface is tuberculated and very hard, and exhibits a bright metallic luster.



URINARY CANAL OF THE OX.

a,—bladder.
b, *b*,—urethra.
c,—sigmoid flexure.
d,—point of rupture.
e,—retractor muscle.

CONCLUSION.

The result of our examination has demonstrated beyond a doubt the early rupture of the bladder, and the survival of the animal until the abdominal cavity is absolutely filled with urine, contrary to the expressed opinions of several professional men. That while an ox may be invariably cured by the removal of the calculus before the bladder bursts, I am now satisfied from further observations on the surgery of such cases, that an animal may be saved by another and more delicate operation if performed a few days after the rupture, before the patient becomes prostrated and thus loaded down with water.